COURSE DATA

DATA SUBJECT

Code: 34764
Name: Chemical engineering laboratory II
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	3	Second quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Experimentation in chemical engineering	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Cuarto curso	COMPULSORY

COORDINATION

LLOPIS ALONSO FRANCISCO

SUMMARY

The objective of this course is for students to be able to plan and carry out experimental studies of varying difficulty in facilities similar to those in a chemical processing industry, explain the results obtained, and prepare reports.

Specifically:

- Operate various industrial equipment and devices related to chemical reactors.
- Take measurements accurately and precisely.
- Proceed methodically when performing calculations.
- Write clear reports on practical exercises.

Contents: Design and conduct experiments in the field of chemical engineering, especially in fluid flow

systems, chemical reaction kinetics, and reactors.

This course is compulsory and is taught to students of both the Bachelor's Degree in Chemical Engineering and the Double Degree in Chemistry and Chemical Engineering, during the second semester.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No enrollment restrictions have been specified for other subjects in the curriculum.

Recommendations:

Have acquired the skills for the following subjects:

* Chemical Reaction Engineering I and II

COMPETENCES / LEARNING OUTCOMES

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Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Design and manage applied experimental procedures, especially for determining thermodynamic and transport properties, and model phenomena and systems in chemical engineering, fluid flow systems, heat transfer, mass transfer operations, chemical reaction kinetics and reactors.

Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans and other similar work.

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

Solve problems with initiative, make decisions, think creatively and critically, and communicate and convey knowledge, skills and competences in the field of industrial engineering.

Understand material and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and the valorisation and transformation of raw materials and energy resources.

Work in a multilingual and multidisciplinary environment.

DESCRIPTION OF CONTENTS

1. Analysis of a battery of continuous stirred tank reactors.

Analysis of a battery of two continuous stirred tank reactors. Steady-state study the process of ethyl acetate with sodium hydroxide. Influence of residence time. Preparation and titration of solutions

2. Analysis of a series combination of several continuous reactors.

Analysis of a series combination of a continuous stirred-tank reactor and two continuous tubular reactors. Steady-state and unsteady-state studies. Process kinetics. Influence of residence time. Preparation and titration of solutions.

3. Study of the best arrangement of several reactors ideal in a multiple reactor system.

Study of the best arrangement of several reactors ideal in a multiple reactor system. Steady-state study the process of phenolphthalein with soda. Kinetics of the process. Influence of residence time. Preparation and titration of solutions.

4. Analysis of a adiabatic batch stirred tank reactor.

Analysis of a adiabatic batch stirred tank reactor. Study of the kinetics of sodium tiosultate process with hydrogen peroxide. Influence of temperature and relative proportions of reactants. Preparation and titration of solutions.

5. Study of the kinetics of a discontinuous process in a stirred tank reactor.

Kinetic study of basic hydrolysis of the ethyl acetate, in a batch stirred tank reactor. Titration of solutions. Influence of the temperature.

6. Study of the flow not ideal, in a battery of continuous reactors.

Study of the flow not ideal, in a battery of continuous reactors. Influence of pulse signal introduced. Analysis of the DTR. Study of model by-pass and dead space. Study of the model of reactors in series.

7. Flow model of a battery of reactors in series.

Flow model of a battery of reactors in series. Influence of the type of signal input. Analysis of the DTR. Comparison with the ideal models.

8. Study of the catalytic oxidative dehydrogenation of n-butane.

Study of the catalytic oxidative dehydrogenation of n-butane. Analysis of the yield and selectivity of the process. Influence of residence time. Basics concepts of applied catalysis. Chromatographic analysis

9. Reactor simulation.

Reactor simulation by hydraulic means. Reactor simulation by computer.

10. Acid Ethyl acetate hydrolysis in a jacketed reactor.

Study of the kinetics of the ethyl acetate hydrolysis, by homogeneous catalysis in acid medium, by means of a volumetric method, at different temperatures, in a jacketed semi-continuous stirred reactor. With the values of the kinetic constants obtained, verify compliance with the Arrhenius equation, and determine the value of the activation energy of this reaction.

11. Fuel Cell Study.

Comparative study of the electrochemical processes that take place in a fuel cell.

12. Study of the basic hydrolysis of acetylsalicylic acid in a batch reactor.

Study of the influence of temperature and pH of the medium on the hydrolysis kinetics of this salt in an unbuffered medium.

13. Kinetic study of phenolphthalein decolourisation in basic medium.

Study of the order of the reaction and determination of the kinetic constant in a basic medium at room temperature.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Laboratory	45,00
Classroom practices	22,50
Total hours	**67,50**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	23,00
Independent study and work	10,00
Preparation of lessons	0,00
Preparation for assessment activities	12,00
Resolution of case studies	0,00
Total hours	**45,00**

TEACHING METHODOLOGY

The experiment will be carried out entirely by the students under the supervision of the instructor, in groups of two, in the laboratories of the Department of Chemical Engineering.

The course will be developed considering several aspects:

i) **Preparation of the experiment**. Students will have access to the script for each of the experiments to be carried out in the University of Valencia's Virtual Classroom, as well as a series of questions related to the theoretical concepts and experimental procedures used in each one. Using the script, the material and information provided by the instructor, students must prepare the experiments to be performed.

ii) **Laboratory work**. An important part of the laboratory work is collecting laboratory data. Students will record the observations and data obtained during the experiment on sheets of paper, along with the data processing and calculations necessary to complete the experiment. This information will be available to the faculty at any time for review and must be presented at the end of the laboratory session for sealing.

iii) **Processing of the results obtained**. The processing of results will begin in the laboratory, with the faculty providing guidance and then completed by the student. One aspect to consider when presenting results is the proper use of units and corresponding significant figures.

iv) **Reports on the practical exercises completed**. One of the objectives of this subject is to familiarize students with the presentation of scientific work. This report will be prepared in pairs and submitted within the deadline set by the faculty. A guide with recommendations for preparing practical exercises reports will be available in the Virtual Classroom.

EVALUATION

The course will be assessed continuously, evaluating the following aspects:

- Continuous student assessment (5% of the final grade), which will assess motivation and degree of autonomy in preparing and completing practical exercises using questionnaires prior to each practical exercise.
- Submitted practical exercise reports. The average of all these activities accounts for 70% of the final grade.
- The individual theoretical exam (25% of the final grade).

Both attendance at the practical exercises and laboratory calculations, as well as taking the exam, are mandatory and required to pass this module. Completing the practical exercises is a non-recoverable activity and is required to pass the course.

Some of the tests, or parts of them, will be minimum requirements, and therefore, students must pass them to pass the course:

The average score on the questionnaires prior to each practical exercise must be 5 out of 10. This minimum score is required to take the theoretical exam. If the student does not achieve this minimum, they will proceed directly to the second sitting, where they must obtain this minimum score prior to the theoretical exam.

- If the student does not obtain a minimum grade of 3 (out of 10) in each of its sections, or a minimum grade of 4 (out of 10) as the average of both sections, the final grade will be the one obtained in the exam.
- If the student does not obtain a minimum grade of 3 (out of 10) in all reports or a minimum grade of 5 (out of 10) as the average of all practical reports, the final grade will be the lower of the two cases presented.
- The student must obtain a minimum grade of 5 (out of 10) to pass the course.

If, despite meeting the minimum requirements, the student does not achieve the minimum final grade of 5, the student must retake the exam in the second sitting, which will be held on the official date, and/or submit reports with a grade lower than 5. The grading criteria will be the same.

Any blatant copying or plagiarism of any assessment activity will result in the inability to pass the course, and the student will be subject to the appropriate disciplinary procedures outlined in the PROTOCOL FOR DEALING WITH FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the assessment system will be governed by the provisions of the University of Valencia's

Assessment and Grading Regulations for undergraduate and master's degrees (ACGUV 108/2017).

REFERENCES

- ESCARDINO A., BERNA. A. Introducció a l'Enginyeria dels Reactors Químics. Universitat de València. (2003)
- SANTAMARÍA, J.M.; HERGUIDO, J.; MENÉNDEZ, M.Á., MONZÓN, A. Ingeniería de reactores, Síntesis, Madrid (1999)
- LEVENSPIEL, O Ingeniería de las reacciones químicas México : Limusa Wiley, (2004)
- FROMENT, G.F., BISCHOFF, K.B. Chemical Reactor Analysis and Design, 2nd ed., John Wiley and Sons. New York. (1990).
- NAUMAN, E.B. Chemical Reactor Design. John Wiley and Sons. New York. (1987).
- FOGLER, H. S. Elements of Chemical Reaction Engineering, 3rd ed., Prentice Hall. New Jersey, (1999)